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EXPRESS MAIL LABEL NO. EL714917725US *Attorney Docket No.: D3299-00016*
PATENT

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frequency differences in optical division chains, generation of optical transmitting frequencies in telecommunications technology, spectroscopic measurement of atomic electronic transitions, or the bridging of the frequency of an optical frequency normal to a measuring frequency that may be counted with electronic means.

REMARKS

Claims 1-32 have been amended to better conform them to U.S. practice. No new matter has been added.

In view of the foregoing remarks and amendments, Applicants submit that this application is in condition for allowance at an early date, which action is earnestly solicited.

The Assistant Commissioner for Patents is hereby authorized to charge any additional fees or credit any excess payment which may be associated with this communication to our deposit account **04-1679**.

Respectfully submitted,

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Version With Markings to Show Changes Made

1. (Amended) Process for the operation of a laser device [(1, 200)], wherein light pulses circulating in a resonator configuration, which consist of spectral components corresponding to multiple longitudinal modes [(M, M_1, M_2)]of the resonator configuration[(3)], are produced and subject to a compensation of the group velocity dispersion, characterized in that a predetermined linear dispersion is introduced into the light path of the resonator configuration[(3)], so that at least one mode possesses a predetermined frequency and/or the mode separation between the modes possesses a predetermined value.

2. (Amended) Process according to claim 1, in which the linear dispersion is introduced into the resonator configuration[(3)] through a spectrally specific effective change of the resonator length in a resonator branch, through which the light pulses traverse spectrally spatially separated after the compensation of the group velocity dispersion.

3. (Amended) Process according to Claim 2, in which the linear dispersion is introduced into the resonator configuration[(3)] through the tilting of a plane resonator end mirror.

4. (Amended) Process according to Claim 1, in which the linear dispersion is introduced into the resonator configuration[(3)] through the tilting of a transparent plane, a pushing in of a pair of prisms in the light path of the resonator configuration[(3)], a setting of the effective pumping power for the pumping of the active medium of the laser device[(1)], or a change of the geometric configuration of the laser device relative to a pump laser.

5. (Amended) Process according to ~~one of the~~ [preceding claims]Claims 1, 2 or 4, in which the linear dispersion is introduced into the resonator configuration[(3)] within the framework of a mode control loop[(I)] dependent upon the frequency deviation of at least one first reference mode[(M_1)] of the light pulses from a reference frequency[(f_{ref})], which is:

- the output frequency of an optical reference frequency generator[(240)],
- a higher harmonic or an even number fraction of the output frequency or of the higher harmonic,
- a frequency multiple of a lower frequency reference mode of the light pulses, or a fractional frequency of a higher frequency reference mode of the light pulses.

6. (Amended) Process according to Claim 5, whereby in the mode control loop[(I)] light pulses of the laser device[(1)] and light with the reference frequency[(f_{ref})] are superposed and directed to a photosensitive element[(211)], whose electrical output signal shows a modulation at a beat frequency corresponding to the distance of the frequency of the first reference mode[(M_1)] from

the reference frequency[(f_{ref})], whereby a control[(214)] is provided, which sets the linear dispersion of the resonator configuration[(3)] so that the beat signal is minimal or possesses a predetermined beat frequency.

7. (Amended) Process according to Claim 5[or 6], whereby the optical reference frequency generator[(240)] is stabilized in a reference laser control loop[(III)] in relation to a second higher frequency reference mode[(M_2)] of the light pulses.

8. (Amended) Process according[to one of the Claims]<u>Claim</u> 5[through 7], whereby the optical reference frequency generator[(240)] is a stabilized continuous wave laser.

9. (Amended) Process according to one of the Claims 1[through]<u>, 2 or</u> 4, whereby the linear dispersion is introduced into the resonator configuration[(3)] within the framework of a mode control loop[(Ia, Ib)] depending upon the deviation of the multiplied frequency of a first reference laser[(240a)], which is phase coupled with a first lower frequency reference mode[(M_1)] of the light pulses, from the frequency of a second reference laser[(240b)], which is phase coupled in a reference laser control loop[(III)] with a second higher frequency reference mode[(M_2)] of the light pulses.

10. (Amended) Process according to Claim 9, whereby the second reference laser[(240b)] is phase coupled with the second higher frequency reference mode[(M_2)] of the light pulses through a scaling stage.

11. (Amended) Process according to one of[the foregoing] Claims<u> 1, 2 or 4</u>, whereby the resonator length of the laser device[(1)] is regulated within the framework of a repetition frequency control loop[(II)], in which the repetition frequency[(fr)] of the light pulses is superposed with a radio frequency derived from a radio frequency generator reference[(25)], whereby a control[(224)] is provided for, which sets the resonator length of the laser device[(1)] so that the oscillating signal formed by the superposition is minimal or possesses a predetermined beat frequency.

12. (Amended) Process according to one of the Claims 1[through]<u>, 2 or</u> 4, whereby the linear dispersion is introduced into the resonator configuration[(3)] within the framework of a repetition frequency control loop[(II)], in which the repetition frequency[(fr)] of the light pulses is superposed with a radio frequency derived from a radio frequency reference generator[(25)], whereby a control[(224)] is provided for, which sets the resonator length of the laser device[(1)] so that the oscillating signal formed by the superposition is minimal or possesses a predetermined beat frequency.

13. (Amended) Process according to Claim 12, whereby the resonator length of the laser device[(1)] is regulated within the framework of a mode control loop[(I)] dependent upon the frequency deviation of at least a first reference mode[(M_1)] of the light pulses from a reference frequency[(f_{ref})], which is the output frequency of an optical reference frequency generator[(24)] or a higher harmonic or an even number fraction of the output frequency or the higher harmonic.

14. (Amended) Process for the operation of a reference laser[(240)] at a stabilized optical frequency, whereby the output frequency of the reference laser[(24)] or a higher harmonic or an even number fraction of the output frequency or of the higher harmonic is phase coupled with a second reference mode[(M_2)] of light pulses, which are produced with a laser device[(1, 200)] according to a process of one of the claims 1[through 13], 2, or 4, whereby the second reference mode[(M_2)] has a frequency different from the first reference mode[(M_1)].

15. (Amended) Process for the measurement of the output frequency of a reference laser[(240)], whereby a reference mode[(M_1)] of light pulses, which are produced with a laser device[(1, 200)] according to a process of one of the claims 1[through 13], 2 or 4, is phase coupled with the output frequency of the reference laser[(240)] or a higher harmonic or an even number fractional of the output frequency or the higher harmonic and the output frequency is determined from the regulating parameters of the laser device.

16. (Amended) Laser device[(1, 200)] for the production of short light pulses, having a resonator configuration[(3)] with

- an active medium[(2)],
- a plurality of resonator mirrors with an incoupling mirror[(31)] for the coupling in of pump light to the active medium[(2)], an outcoupling mirror[(32)] for the output of light pulses and several tilted mirrors[(33a-c, 34)], and
- a compensating mechanism[(4)] for the compensation of the group velocity dispersion of the light pulses,[characterized in that] wherein the resonator configuration[(3)] includes a dispersion setting device[(7, 8, 8')] for the introduction of a linear dispersion into the light path of the resonator configuration[(3)].

17. (Amended) Laser device according to Claim 16, whereby the dispersion setting device[(7)] is located in a branch of the resonator on the side of the compensating mechanism[(4)] facing away from the active medium[(2)].

18. (Amended) Laser device according to Claim 17, whereby the dispersion setting device[(7)] is

a pivoting mechanism[(7)] on an tilted mirror functioning as a resonator end mirror[(34)].

19. (Amended) Laser device according to Claim 16, whereby the dispersion setting device comprises a transparent plate with a tilting mechanism[(8)], a pair of prisms with a sliding mechanism[(8')], which are included in the resonator configuration[(3)], an apparatus[(9)] for the variation of the effective pump power of the pump laser, or an apparatus for the variation of the geometrical configuration of the laser device relative to a pump laser.

20. (Unchanged) Laser device according to Claim 16, which is constructed as a ring laser.

21. (Amended) Laser device according to [Claims]<u>Claim</u> 16[through 20], whereby a resonator length setting device[(5)] is provided for the change of the resonator length through a change in positioning of one of the tilted mirrors[(33b)].

22. (Amended) Laser device according to [Claims]<u>Claim</u> 16[through 21], whereby a mode control loop[(I, 210, 214)] is provided for the regulation of the dispersion setting device[(7, 8, 8')] or the regulation of the resonator length setting device[(5)], dependent upon the frequency deviation of at least one frequency component of the light pulses from a reference frequency[(f_{ref})], which is the output frequency of an optical reference frequency generator[(240)] or a higher harmonic or an even number fraction of the output frequency or of the higher harmonic or a multiplied frequency of a lower frequency reference mode or a divided frequency of a higher frequency reference mode of the light pulses.

23. (Amended) Laser device according to Claim 22, whereby the mode control loop[(I, 210, 214)] includes an apparatus[(211)] for the production of a beat signal from the frequency component of the light pulses and the reference frequency[(f_{ref})] and a mode control[(214)] for the dispersion setting device[(7)] or the resonator length setting device[(5)], so that the dispersion setting device[(7)] or the resonator length setting device[(5)] is activated in such a way that the beat signal is either minimal or possesses a predetermined beat frequency.

24. (Amended) Laser device according to one of the Claims 22 or 23, whereby a reference laser[(240)] and possibly multiplier or divider stages are provided for the generation of the reference frequency[(f_{ref})] and the device for the production of the beat signal includes a photosensitive element[(211)].

25. (Amended) Laser device according to Claim 24, whereby a filter element[(212)] for spectral selective detection of the light pulses is provided at the photosensitive element.

26. (Amended) Laser device according to one of the [Claims]Claim 16[through 21], whereby a mode control loop[(I, 210, 214)] is provided for the regulation of the dispersion setting device[(7, 8, 8')] or the regulation of the resonator length setting device[(5)], dependent upon the frequency deviation of the frequency of a first reference laser[(240a)], which is phase coupled with a first lower frequency reference mode[(M_1)] of the light pulses, from the frequency of a second reference laser[(240b)], which is phase coupled with a second higher frequency reference mode[(M_2)] of the light pulses.

27. (Amended) Laser device according to [one of the Claims] Claim 16[through 26], whereby a repetition frequency control loop[(II, 220, 224)] is provided for the regulation of the resonator length setting device[(5)] or the dispersion setting device[(7, 8, 8')], dependent upon the frequency deviation of at least one differential frequency between the repetition frequency of the light pulses and a radio frequency.

28. (Amended) Laser device according to Claim 27, whereby a radio frequency reference generator[(25)] is provided for the generation of the reference radio frequency and the repetition frequency control loop comprises a device for the generation of a beat signal from the signal of a photosensitive element[(221)] that captures the light pulses, and from the signal of a radio frequency reference generator[(250)], and a reference frequency control[(224)] for the resonator length setting device[(5)] or the dispersion setting device[(7, 8, 8')], whereby the repetition frequency control[(224)] is structured so that the resonator length setting device or the dispersion setting device[(7, 8, 8')] is operated so that the second oscillating signal is minimal or possesses a predetermined beat frequency.

29. (Amended) Laser device according to [one of the]Claims 21[through 28], 22, 26 or 27, whereby further a reference laser control loop[(III, 231)] is provided for the regulation of the optical reference frequency generator or reference laser[(240)], with a device[(231)] for the generation of a beat signal from a higher frequency component of the light pulses or a part of this frequency component and a frequency equal to a multiple of the reference frequency[(f_{ref})], and a setting device for the setting of the optical reference frequency generator or reference laser[(240)] so that the beat signal is minimal or has a predetermined beat frequency.

30. (Amended) Laser device according to [one of the Claims]Claim 16[through 29], whereby the active medium[(4)] includes a solid or a dye medium.

31. (Amended) Laser device according to [one of the Claims]Claim 16[through 30], whereby a device[(201)] is provided for self phase modulation.

32. (Amended) [Application of a process or]Method of using a laser device according to [one of the preceding claims]Claim16 for the measurement of optical frequencies of frequency differential, generation of optical frequencies, bridging of large frequency differences in optical division chains, generation of optical transmitting frequencies in telecommunications technology, spectroscopic measurement of atomic electronic transitions, or the bridging of the frequency of an optical frequency normal to a measuring frequency that may be counted with electronic means.

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